Nuclear and Atomic Physics

AN INVESTIGATION OF THERMALLY-INDUCED CRAZING IN BC-408 SCINTILLATING PLASTIC

Ryan P. Jorn †, Scott Nutter, James Beatty*‡

The CREAM experiment group at Penn State is designing a particle detector that will be launched from Antarctica in 2003/2004. One of the factors affecting the detector's efficiency will be the degree of imperfection and cracks on the surface of several plastic pieces housed within it. A known process that can cause imperfections in the surface of a plastic material is known as "crazing". Crazing is the process of micro crack formation on the surface of a stressed material. These micro cracks are very detrimental to scintillator particle detectors, which attempt to detect signature photons caused by relativistic speed particles.

Among the particle physics community there is a great deal of rumor about what types of stress can cause crazing, but factual information on what can lead to micro crack formation is not plentiful. An investigation into the alleged thermal conditions responsible for crazing was conducted on BC-408 scintillator plastic. Samples of the plastic were placed in an environmental chamber and stressed by simulating various types of thermal environments. These stresses included exposing the samples to Antarctic temperatures for extended periods of time, cycling the temperature of the samples gradually, and putting only one face of the sample in contact with a sand bath at a significantly higher temperature. The results of this investigation indicate that thermal stresses alone cannot induce crazing on the plastic's surface. Crazing was also not observed as a result of fast evaporating alcohols stressing the surface of the plastic. The conclusion of this project is that the plastic surfaces of the CREAM particle detector should be safe from crazing provided no other stresses are applied to the material.

† Ryan Jorn
600 Campus Dr. Unit #313
Ripon, WI 54971
jornr@ripon.edu

‡ James J. Beatty
303F Osmond Lab, #253
University Park, PA 16802-6300
jjb@phys.psu.edu